

**RTCA Special Committee 186, Working Group 3**

**ADS-B 1090 MOPS, Revision A**

**Meeting #16**

**Proposed Changes to Correct NIC Encoding Errors**

**Presented by Jim Maynard**

SUMMARY
<p>In reviewing the first of the EUROCAE comments in Working Paper 1090-WP-16-03, Vince Orlando noticed that Table 2-11 in §2.2.3.2.3.1 of our draft MOPS does not follow my original proposal shown in my working paper, 1090-WP-5-10A, where I proposed the NIC supplement field as a way of providing compatibility between DO-260-compliant equipment and DO-260A-compliant equipment. WG-3 asked me to review our current draft to identify the parts of the main document (sections 1 to 4) that would need to be changed to correct this apparent error.</p> <p>This addresses that action item. The following pages show proposed changes in §2.2.3.2.3.1 and §2.2.3.2.7.2.6, <b>highlighted in yellow</b>. (I have also made changes in a copy of the draft document, 1090-Sec_1+2+3+4-Draft-7.doc, for our editor's benefit.)</p> <p>The test procedure for the NIC supplement field, in section §2.4.3.2.7.2.6, is worded in such a way that it does <i>not</i> have to be changed. (The test procedure refers to the NIC supplement table in §2.2.3.2.7.2.6.)</p>

#### 2.2.3.2.3.1 “TYPE” Subfield in ADS-B Airborne Position Messages

The “TYPE” subfield is a 5-bit (“ME” bits 1 through 5, Message bits 33 through 37) field that **shall** be used to identify the ADS-B Message and to differentiate between several message types.

1. Airborne Position Message (§**Error! Reference source not found.**)
2. Surface Position Message (§**Error! Reference source not found.**)
3. Aircraft Identification (ID) and Type Message (§**Error! Reference source not found.**)
4. Airborne Velocity Message (§**Error! Reference source not found.**)
5. Target State and Status Message (§**Error! Reference source not found.**)
6. Aircraft Operational Status Message (§**Error! Reference source not found.**)
7. Test Message (TYPE=23) (§**Error! Reference source not found.**)
8. Aircraft Status Message (TYPE=28) (§**Error! Reference source not found.**)

In the case of ADS-B Airborne Position Messages (§**Error! Reference source not found.**), the Message TYPE subfield (§2.2.3.2.2) **is also used in the following ways:**

- a. The TYPE subfield indicates the altitude type (barometric pressure altitude, §**Error! Reference source not found.**, or geometric altitude, §**Error! Reference source not found.**) being communicated in the airborne position message.
- b. Together with the NIC Supplement subfield in the Aircraft Operational Status Message (§2.2.3.2.7.2.6), the TYPE subfield encodes the Navigation Integrity Category (NIC) (see Table 2.2.3.2.7.2.6).

For Surface Position Messages (§**Error! Reference source not found.**), the TYPE subfield, together with the NIC subfield, encodes NIC – but not altitude type, since altitude is not reported in Surface Position Messages.

Detailed definition of the “TYPE” subfield encodings that **shall** be used for all ADS-B Airborne Position and Surface Position Messages are provided in Table 2-11. For Airborne Position Messages and Surface Position Messages, that Table also shows how the NIC value can be determined from the value of the TYPE subfield (of Airborne Position Messages) and the NIC Supplement Subfield (of Aircraft Operational Status Messages).

The ADS-B Airborne Position Messages **shall** use only “TYPE” Codes 0, 9 through 18 and codes 20 through 22 as indicated in Table 2-11.

**Table 2-11: “TYPE” Subfield Code Definitions (DF = 17 or 18)**

TYPE Code	Subtype Code	NIC Supplement	Format (Message Type)	Horizontal Containment Radius Limit (R <sub>C</sub> )	Navigation Integrity Category (NIC)	Altitude Type	Notes
0	Not Present	Not Applicable	No Position Information (Airborne or Surface Position Message)	R <sub>C</sub> unknown	NIC = 0	Baro Altitude or No Altitude Information	1, 2, 3
1	Not Present	Not Applicable	Aircraft Identification and Type Message (§Error! Reference source not found.)	Not Applicable	Not Applicable	Not Applicable	Category Set D
2							Category Set C
3							Category Set B
4							Category Set A
5	Not Present	0	Surface Position Message (§Error! Reference source not found.)	R <sub>C</sub> < 7.5 m	NIC = 11	No Altitude Information	6
6		R <sub>C</sub> < 25 m		NIC = 10			
7		R <sub>C</sub> 75 m		NIC = 9			
8		R <sub>C</sub> < 0.1 NM (185.2 m)		NIC = 8			
		R <sub>C</sub> ≡ 0.1 NM (185.2 m) or unknown		NIC = 0			
9	Not Present	0	Airborne Position Message (§Error! Reference source not found.)	R <sub>C</sub> < 7.5 m and VPL < 11 m	NIC = 11	Baro Altitude	5
10		R <sub>C</sub> < 25 m and VPL < 37.5m		NIC = 10	5		
11		R <sub>C</sub> < 75 m and VPL < 112 m		NIC = 9	6		
		12		R <sub>C</sub> < 0.1 NM (185.2 m)			NIC = 8
13		R <sub>C</sub> < 0.2 NM (370.4 m)		NIC = 7			
		R <sub>C</sub> < 0.6 NM (1111.2 m)		NIC = 6			
14		R <sub>C</sub> < 0.5 NM (926 m)					
15		R <sub>C</sub> < 1.0 NM (1852 m)		NIC = 5			
16		R <sub>C</sub> < 2 NM (3.704 km)		NIC = 4	7		
		R <sub>C</sub> < 4 NM (7.408 km)		NIC = 3			
17		R <sub>C</sub> < 8 NM (14.816 km)		NIC = 2			
18		R <sub>C</sub> < 20 NM (37.04 km)		NIC = 1			
		R <sub>C</sub> = 20 NM (37.04 km) or unknown		NIC = 0			
19		0		Not Applicable	Reserved		Not Applicable
	1 – 4	Airborne Velocity Message (§Error! Reference source not found.)					
	5 – 7	Reserved					
20	Not Present	0	Airborne Position Message (§Error! Reference source not found.)	R <sub>C</sub> < 7.5 m and VPL < 11 m	NIC = 11	GNSS Height (HAE)	2, 5
21		R <sub>C</sub> < 25 m and VPL < 37.5 m		NIC = 10	2, 5		
22		R <sub>C</sub> ≧ 25 m or VPL ≧ 37.5 m or R <sub>C</sub> or VPL is unknown		NIC = 0	2		
23	0	Not Applicable	Test Message (§Error! Reference source not found.)				
24	Reserved for Surface System Status (§Error! Reference source not found.)						
25 – 26	Reserved (§Error! Reference source not found. and §Error! Reference source not found.)						
27	Reserved for Trajectory Change Message (§Error! Reference source not found.)						
28	0		Reserved				
	1		Extended Squitter Aircraft Status Message (Emergency/Priority Status) (§Error! Reference source not found.)				
	2 – 7		Reserved				
29	0		Target State and Status Message (§Error! Reference source not found.)				
	1 – 3		Reserved				
30	0 – 7		Reserved				
31	0 – 1		Aircraft Operational Status Message (§Error! Reference source not found.)				
	2 – 7		Reserved				

#### 2.2.3.2.7.2.6 “NIC Supplement” Subfield in Aircraft Operational Status Messages

The NIC Supplement subfield in the Aircraft Operational Status Message is a one-bit subfield (“ME” bit 44, Message bit 76) that, together with the TYPE subfield in Airborne Position and Surface Position Messages, **shall** be used to encode the Navigation Integrity Category (NIC) of the transmitting ADS-B participant.

*Note:* The Navigation Integrity Category (NIC) is reported so that surveillance applications may determine whether the reported geometric position has an acceptable level of integrity for the intended use. See §2.1.2.12 of RTCA DO-242A, the ADS-B MASPS, for a fuller description of the Navigation Integrity Category.

If an update has not been received from an on-board data source for the NIC Supplement within the past 5 seconds, then the NIC Supplement subfield **shall** be encoded as ZERO (0) to indicate the larger Radius of Containment ( $R_C$ ).

Table 2.2.3.2.7.2.6 lists the possible NIC codes and the values of the TYPE subfield of the Airborne and Surface Position Messages, and of the NIC Supplement subfield that **shall** be used to encode those NIC codes in messages on the 1090 MHz ADS-B data link.

**Table 2.2.3.2.7.2.6: Navigation Integrity Category (NIC) Encoding.**

NIC Value	Containment Radius ( $R_C$ ) and Vertical Protection Limit (VPL)	Airborne		Surface	
		Airborne Position TYPE Code	NIC Supplement Code	Surface Position TYPE Code	NIC Supplement Code
0	$R_C$ unknown	0, 18 or 22	0	0 or 8	0
1	$R_C < 20$ NM (37.04 km)	17	0	N/A	N/A
2	$R_C < 8$ NM (14.816 km)	16	0	N/A	N/A
3	$R_C < 4$ NM (7.408 km)	16	1	N/A	N/A
4	$R_C < 2$ NM (3.704 km)	15	0	N/A	N/A
5	$R_C < 1$ NM (1852 m)	14	0	N/A	N/A
6	$R_C < 0.6$ NM (1111.2 m)	13	1	N/A	N/A
	$R_C < 0.5$ NM (926 m)		0		
7	$R_C < 0.2$ NM (370.4 m)	12	0	N/A	N/A
8	$R_C < 0.1$ NM (185.2 m)	11	0	7	0
9	$R_C < 75$ m and VPL < 112 m	11	1	7	1
10	$R_C < 25$ m and VPL < 37.5 m	10 or 21	0	6	0
11	$R_C < 7.5$ m and VPL < 11 m	9 or 20	0	5	0

*Note:* “N/A” means “This NIC value is not available in the ADS-B Surface Position Message formats.”